Title: Our School Looks Cool!

Brief Overview:

This learning unit requires students to make predictions, organize information, and determine and describe patterns. Students reflect to explain, compare, contrast, and describe pattern rules. The unit will help students plan gardens to beautify school grounds. If your school does not have a school wide clean-up day, this unit might be used as an Earth Day extension.

Links to NCTM Standards:

- **Mathematics as Problem Solving**
  Students will demonstrate their ability to work in a cooperative atmosphere to solve open-ended problems involving patterns.

- **Mathematics as Communication**
  Students will demonstrate their ability to communicate mathematically. They will identify, compare, contrast, and explain patterns incorporating the symbols and vocabulary of mathematics.

- **Mathematics as Reasoning**
  Students will demonstrate their ability to think mathematically. They will collect data, explain their patterns, and justify their conclusions about patterns.

- **Mathematical Connections**
  Students will connect patterns to real-life situations.

- **Patterns and Relationships**
  Students will recognize numeric relationships and will generalize a relationship from data.

Grade/Level:

This unit is appropriate for third and fourth grade students.

Duration:

2-3 class periods

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Basic operations
- Categorizing
- Cooperative learning
- Number sense
- Constant key on calculator
- Writing skills, including letter writing

Objectives:

Students will:

- describe, identify, compare, contrast, and explain patterns orally and in writing.
- use a function table to organize data and identify, describe, and explain patterns.

Materials/Resources/Printed Materials:

- Calculators
- Sentence strips
- Pattern blocks
- Pattern block stickers
- Chart paper for groups
- Student Resource Worksheet 1
- Student Resource Worksheet 2

Development/Procedures:

Lesson 1: Plotting Patterns

Procedures:

Step 1: Present the following scenario to students. "We are planning a *School is Cool Day*. We will be engaged in activities to improve our school grounds. We will be planning activities so that we are organized and can complete all the work on one day. The first activity we will participate in is planning a class garden. Each class will have a plot of ground outside their classroom to turn into a flower garden. We need to determine a planting pattern so that our garden is attractive. Before we can start planning our garden, we need to explore pattern choices.

Step 2: Teacher will present on the overhead projector a repeating AB pattern. Students use manipulatives such as pattern blocks or multilink cubes to copy the pattern at their desks and continue the pattern for at least three terms. Give the students a variety of experiences with AB patterns and variations of three item patterns (ABBC, ABCA). Ask students to think, pair, share with a partner to describe various patterns. When the students have an understanding of replicating and continuing patterns, introduce the symbols for describing the patterns such as the letters AB. Introduce vocabulary: term, core, rule.

Term: reference to the position in a sequence; in an ABCD pattern, B is the second term D is the fourth term.
Core: smallest unit that repeats in a pattern; in an ABABABAB pattern, AB is the core.
Rule: Description of how the pattern replicates.

Step 3: Adding a third item or color, the students create their own patterns. Then, working in partners, one student creates a pattern and the second student copies and extends the pattern for three terms. The second student explains the pattern to the first student using math vocabulary. The students switch roles.

Step 4: The students create an individual pattern on sentence strips to be shared with the class. The students can use pattern block stickers or they can trace and color the shapes. Students reflect in their math journals by describing their patterns so that a friend in another team could replicate the pattern. Students use math vocabulary in their entries.

Step 5: In pairs, the students compare and contrast three patterns such as those below, and record their data on chart paper to be displayed. Students are to use math vocabulary in their responses. Students should describe their patterns at the bottom of their charts.

Red	Blue	Blue	Green	Red	Blue	Blue	Green	Red	Blue

Red	Blue	Green	Red	Red	Blue	Green	Red	Red	Blue

Blue	Red	Blue	Red	Blue	Red	Blue	Red	Blue	Red

The teacher facilitates a discussion aimed at creating an exemplary comparison using the data from the group charts. Record an exemplar. Groups revise their responses with the exemplar as the target.

Step 6: Evaluation. Using sentence strips or drawing paper, individual students create a flower pattern for the class garden. On the back of their drawing, the students describe their pattern using math vocabulary. The teacher again facilitates a discussion aimed at creating an exemplary description of a pattern. Students revise their descriptions with the exemplar as the target.

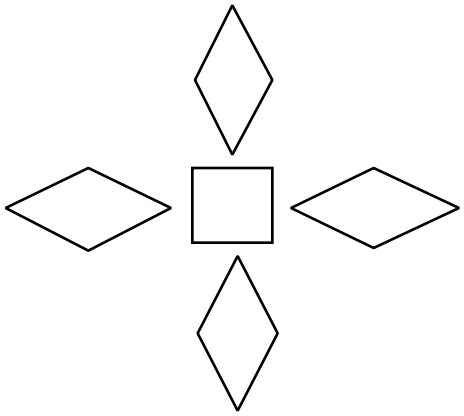
Extension: Students can categorize the individual garden patterns.

Lesson 2: Messing with Mulch

Procedure:

Step 1: Present the following scenario to the students: "We are in charge of organizing and planning the mulch brigade for our school beautification day. We need to place mulch around the base of the trees in the school yard to help hold the moisture in the ground for the trees. We need to determine the number of buckets of mulch for the trees on the school grounds. Before we can solve this problem we need to explore a way to organize data so we can make accurate calculations.

Step 2: The teacher presents the pattern for a flower on the overhead while the students replicate with pattern blocks. Here is one example:



Ask students questions similar to these: "One flower uses five blocks. How many blocks for two flowers? Build the flower on your desk with your pattern blocks to find the answer. Convince me. With a partner, can you find how many blocks for three flowers? Seven flowers? Convince me. How did you solve the problem? Why did you solve the problem that way? What's the rule for finding the number of blocks in any number of flowers? Convince me. Have we solved a problem similar to this?" Some students may be able to make the connection with multiplication, while other students will need to build the flowers. Either way is acceptable as long as students can justify their responses. Repeat this activity using other patterns such as fish, ships, or stars. Be sure to use different numbers of pattern blocks.

Step 3: Pick one of the examples students explored in step two, and model a function table. Some students might have already discovered this.

Number of Flowers	Number of Blocks
1	5
2	10
3	15
7	?

Rule: The number of flowers multiplied by five equals the number of blocks.

Students identify the relationships between the numbers in the columns. Then students identify the relationships in a row to determine the rule. Revisit other examples from Step 2 for guided practice with creating function tables and determining rules.

Step 4: Present another pattern to the students. The students create a function table with a partner and write the rule for discovering the number of blocks. The students must explain to each other and the teacher how they used a table to help them solve the problem. Some students may need to create the shapes in order to create the table. Students record in their individual journals how a function table helped them discover the pattern rule. Share.

Step 5: Use the table students created in Step 4 to practice using the constant key on a calculator. Revisit previously created tables to draw connections between multiplication facts (multiples), the calculator constant key, and the function table. It is appropriate for students to use the constant key to determine data for a function table. For example:

0 + 5 =, =, =, =

Step 6: Evaluation. Return to the task of mulching trees. Remind students that each tree needs three buckets of mulch. Explain to the students that at this time we don't know the exact number of trees on the school property, so determining the rule is important so that no matter how many trees there are, we can calculate the number of buckets of mulch. Students are challenged to find out how many buckets are needed for one tree, two trees, three trees, seven trees, nineteen trees. Students write a note to the teacher explaining how they will determine the number of buckets of mulch. Student must justify their answers and include math vocabulary. The teacher facilitates a discussion aimed at creating an exemplary note. Students revise their note with the exemplar as the target.

Lesson 3: PLANTS! PLANTS! PLANTS!

Procedures:

Step 1: Present the following scenario to the students. "The PTA is purchasing plants for the class gardens. The nursery has discounted plants purchased in quantities. The PTA has asked for our help with determining the cost of the plants. The plants are priced as follows: 1 plant for $14, 2 plants for $26, 3 plants for $36. How much for 5 plants? How much for 7 plants? Students will have calculators and knowledge of organizing information. Allow the students to attempt to solve this problem in teams of four. Ask the students "What, if anything, do you notice about the cost per plant?"

Number of Plants	Cost
1	$14
2	$26
3	$36
4	?
5	?
6	?
7	?

Number of Plants	Cost	Cost per Plant
1	$14	$14
2	$26	$13
3	$36	$12
4		
5	?	?
6		
7	?	?

Step 2: Teams pair and share their results. Allow teams to revise their conclusions. Teams report to the group. Facilitate a discussion about how the rule was generated. Ask students to compare and contrast this problem with similar problems they have solved.

Step 3: Write a class letter to the PTA reporting the class results. Justify your conclusion and include math vocabulary.

Step 4: Students independently complete the task on Student Worksheet 1.

Performance Assessment:

Our school wants to honor the School Volunteer of the Year by planting a tree in his or her honor. The nursery will sell the plants at a discount. The nursery sells trees at the following prices: 7 trees for $224; 6 trees for $198; 5 trees for $170. The principal needs to know how much one tree will cost. Write a note to the principal explaining the cost of one tree. Justify your cost using data and math vocabulary. Refer to Student Worksheet 2.

Extension/Follow Up:

Step 1: Give the students the following scenario: "Some of the flower beds we will be planting will be wedge-shaped. The plants will be arranged in the following way":

Step 2: Present the students with pattern blocks arranged similarly to the set below. Students should copy the pattern. Challenge the students to determine the next four or five terms.

Red	White	Red	White	White	Red	White	White	White	Red	?	?	?	?

White	Red	White	Red	Red	White	Red	Red	Red	White	?	?	?	?

Teacher will assess individual students as they work. If students are having difficulty seeing the growing pattern, remediate by breaking the sequence into smaller sets.

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PLANTS! PLANTS! PLANTS!

The PTA wants to purchase bushes for beautifying our school grounds. The nursery priced the bushes at 1 for $10, 2 for $18, and 3 for $24. How much for 7 bushes? Our class recommends that the PTA purchase 7 bushes. Write a letter to the PTA to persuade them that our recommendation is the best value. Include data from your table and math vocabulary to justify your results.

Answer Key for “Plants! Plants! Plants!”

Number of Bushes	Cost	Cost per Plant
1	$10	$10
2	$18	$ 9
3	$24	$ 8
4	$28	$ 7
5	$30	$ 6
6	$30	$ 5
7	$28	$ 4

Scoring Tool for “Plants! Plants! Plants!”

3 Exemplary response: includes rule, function table, correct data, and complete explanation.

2 Correct data, rule, function table, and explains two of three pieces of information.

1 Least acceptable correct response, includes correct data and partial explanation.

Volunteer of the Year

Our school wants to honor the School Volunteer of the Year by planting a tree in his or her honor. The nursery will sell the plants at a discount. The nursery sells trees at the following prices: 7 trees for $224; 6 trees for $198; 5 trees for $170. The principal needs to know how much for one tree. Write a note to the principal explaining the cost of one tree. Justify your cost using data and math vocabulary.

Answer Key for “Volunteer of the Year”

Number of Trees	Cost	Cost per Tree
1	$ 38	$38
2	$ 74	$37
3	$108	$36
4	$140	$35
5	$170	$34
6	$198	$33
7	$224	$32

Scoring Tool for “Volunteer of the Year”

3 Exemplary response: includes rule, function table, correct data, and complete explanation.

2 Correct data, rule, function table, and explains two of three pieces of information.

1 Least acceptable correct response, includes correct data and partial explanation.